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XVII. "On the Change in the Elastic Force of a Constant Volume of dry Atmospheric Air, between 32° F. and 212° F., and on the Temperature of the Freezing-point of Mercury." By BALFOUR STEWART, M.A., F.R.S. Received June 18, 1863.

(Abstract.)

The author gave a detailed description of his apparatus, and of the method employed in drying the air.

The result of his experiments gave as the coefficient of increase of elasticity of air of constant volume for 1° F. 0·002040, this being slightly different from that given by Regnault, which is 0·002036.

He also finds that the temperature of the freezing-point of mercury is constant, and that its value on Fahrenheit's scale, as given by an air-thermometer, is −37°·93, while as recorded by a standard mercurial thermometer it is −38°·00. It is probable that this difference is owing to an anomalous contraction of mercury before it freezes, similar to the corresponding expansion of water; but this effect in the case of mercury seems to be very small, and it may be said that a mercurial thermometer properly graduated, will denote the true temperature, even down to the freezing-point of the mercury itself.

XVIII. "On the Degree and Weight of the Resultant of a Multipartite System of Equations." By Professor J. J SYLVESTER, F.R.S. Received May 25, 1863.

Let there be $(1+n)$ equations each homogeneous in any number of sets of variables, and suppose that the degrees of the several equations in respect to these sets are respectively

$$\begin{array}{l} a,\ b,\ c,\ \ldots,\ l, \\ a_1,\ b_1,\ c_1,\ \ldots,\ l_1, \\ a_2,\ b_2,\ c_2,\ \ldots,\ l_2, \\ \ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots \\ a_n,\ b_n,\ c_n,\ \ldots,\ l_n, \end{array}$$

where the a, b, c, &c. are any positive integers, zero not excluded.

Let the number of variables in the several sets be respectively

$1+\alpha$, $1+\beta$, $1+\gamma$, . . . $1+\lambda$, then in order that the system may have a resultant, since the number of ratios to be eliminated is $\alpha+\beta+\gamma+\ldots+\lambda$, this sum must be equal to n.

Let

$$a_i\varrho+b_i\sigma+c_i\tau+\ldots+c_i\omega=L_2,$$

and let

$$LL_1, L_2, \ldots L_n=P, \text{ then}$$

1st, the degree of the resultant in question in regard to the coefficients of the rth equation will be the coefficient of $\varrho^\alpha.\sigma^\beta.\tau^\gamma\ldots\omega^\lambda$ in $\frac{P}{L_r}$.

2nd. As regards weight. By the weight of any letter in respect to any given variable is to be understood the exponent of that variable in the term affected with the coefficient; and by the weight of any term of the resultant in respect to such variable, the sum of the weights of its several simple factors; each term in the resultant in respect to any given variable has the same weight; and this weight may also be proved to be alike for each variable in the same set, and may be taken as the weight of the resultant in respect to such set. This being premised, we have the following theorem:—

The value of the weight of the resultant in respect to any particular set of the variables, *ex. gr.* the $(1+\alpha)$ set, will be the coefficient of

$$\varrho^{1+\alpha}.\sigma^\beta.\tau^\gamma\ldots\omega^\lambda \text{ in } P.$$

In the particular case where $\alpha=\beta=\gamma\ldots=\lambda$, the above expressions for the degree and weight evidently become polynomial coefficients. Thus, *ex. gr.*, if we suppose each equation *linear* in respect to the variables of each set, the degree of the resultant in respect to the coefficients of any equation will be

$$\frac{\pi(\alpha+\beta+\gamma\ldots+\lambda)}{\pi\alpha.\pi\beta.\pi\gamma\ldots\pi\lambda},$$

and its weight in respect to the $(1+\alpha)$ set will be

$$\frac{\pi(1+\alpha+\beta+\ldots+\lambda)}{\pi(1+\alpha)\pi\beta.\pi\gamma\ldots\pi(\lambda)}.$$

In particular if each set is binary, so that $\alpha=\beta=\gamma\ldots=\lambda=1$, the degree becomes $\pi(n)$, and the weight $\frac{\pi(1+n)}{2}$.

The above theorems are, I believe, altogether new.

It may just be noticed (as a passing remark) that the total degree in the general case is the coefficient of

$$\varrho^{\alpha}.\sigma^{\beta}.\tau^{\gamma}\ldots\omega^{\lambda} \text{ in } \mathrm{P}\left\{\frac{1}{\mathrm{L}}+\frac{1}{\mathrm{L}_1}+\ldots+\frac{1}{\mathrm{L}_n}\right\},$$

and the *total* weight the coefficient of the same argument in

$$\mathrm{P}\left\{\frac{1}{\varrho}+\frac{1}{\sigma}+\ldots+\frac{1}{\omega}\right\}.$$

XIX. "Some Remarks appended to a Report on Mr. Hopkins's Paper 'On the Theory of the Motion of Glaciers'*". By Sir JOHN F. W. HERSCHEL, Bart., F.R.S. (Referee). Received January 31, 1863.

A few remarks arising out of the perusal of this paper may perhaps not be considered as out of place on the present occasion. They are not meant as in any way impugning the author's views of the laws determining the fracture and disruption of glacier masses, or their application to glacier-phenomena in general, but in relation to the somewhat mysterious process of regelation itself, and to those generally recognized and most remarkable facts of the gradual conversion of snow into more or less transparent ice, and the reunion of blocks and fissured or broken fragments, under the joint influence of renewed pressure and of that process (whatever its nature), into continuous masses. If regelation be really a process of crystallization, it seems exceedingly difficult to imagine how the molecules forming the cementing layer between two juxtaposed surfaces can at once arrange themselves conformably to the accidentally differing axial arrangements of those of the two surfaces cemented. A macled crystal is indeed a crystallographical possibility; but then the axes of the two individuals cohering by the macle-plane have to each other a definite geometrical relation in space, as is well exemplified in the case of the interrupting film in Iceland spar. At the temperature at which "regelation" takes place (viz. the precise limit between the liquid and solid states), it seems to me very possible that the cohesive forces of the molecules of the cemented surfaces may be so nearly counteracted as to bring those surfaces into what may be so far regarded

* Read May 22, 1862.